Citation:

Liu S, Serdula MK, Williamson DF, Mokdad AH, Byers T. A prospective study of alcohol intake and change in body weight among US adults. *Am J Epidemiol.* 1994 Nov 15; 140(10): 912-920.

PubMed ID: 7977278

Study Design:

Cross-Sectional Study

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To provide accurate estimates of weight change attributable to alcohol intake using data from a national sample of US adults participating in first National Health and Nutrition Examination Survey (NHANES).

Inclusion Criteria:

Adults aged 25 to 74 years who were examined from 1971 through 1975 and were eligible for inclusion in the NHANES I Epidemiologic follow-up study.

Exclusion Criteria:

- Not adults aged 25 to 74 years who were examined from 1971 through 1975 for eligibility for inclusion in the NHANES I Epidemiologic follow-up study
- Adults who were screened for the NHANES I Epidemiologic follow-up study, but were found to:
  - Have missing vital status data at follow-up
  - Be alive, but were not re-interviewed
  - Have died
  - Have no information on their caloric intake at baseline
  - Be pregnant at baseline or follow-up
  - Have an unknown height or weight measurement at baseline or follow-up
  - Have missing drinking information on baseline or follow-up
  - Have missing values for one or more other covariates used in the analysis.

Description of Study Protocol:

Recruitment

The current study is using secondary data from the NHANES I Epidemiologic follow-up study.

Design

- Cross-sectional and prospective analysis of data collected from NHANES I Epidemiologic follow-up study. Participants were re-weighed ten years after the initial participation in NHANES I
- In some analyses, weight change status was defined as major weight gain (weight change, 10kg or more gain) or major weight loss (weight change, 10kg or more loss) over the follow-up period.

Dietary Intake/Dietary Assessment Methodology

- Alcohol consumption, expressed as drinks per day, was assessed at baseline using quantity-frequency questions on the medical history interview
- Study population was categorized into six groups:
    - *Non-drinkers:* Those who reported that they did not drink during the past year
    - *Infrequent drinkers:* Those who had fewer than 12 drinks a year
    - *Very light drinkers:* Those who had 12 or more drinks a year but less than one drink a week
    - *Light drinkers:* Those who had one or more drinks a week but less than one drink per day
    - *Moderate drinkers:* Those who drank one to 1.9 drinks per day
    - *Heavy drinkers:* Those who had two or more drinks per day

Statistical Analysis

- Sex-specific cross-sectional analyses were conducted to estimate mean body differences between non-drinkers and drinkers at baseline, using multiple linear regression analysis to adjust for covariates
- That same technique and analysis was used to examine whether alcohol intake was related to the longitudinal change in body weight over the 10-year follow-up period
- Multiple polytomous logistic regression analysis was used to estimate relative odds of major weight gain or weight loss over the follow-up period by the amount of alcohol intake at baseline
- Used standard diagnostic tests and the residual plot for linear regression to assess goodness-of-fit
- Separate analyses were carried out after stratifying by health status.

Data Collection Summary:

Timing of Measurements

- Weight and height was measured at baseline and 10 years later at follow-up
- Alcohol consumption was measured at baseline.

Dependent Variables

- Body weight and height, mean BMI (body mass index), weight gain and weight loss
- Height was measured by using a level platform with a vertical bar (to which was attached a steel tape); weight was measure on a self-balancing scale and measured at follow-up with a portable spring scale (adjustments were made to include removed shoes and extra articles of clothing and the adjustment of -1.6kg for indoor clothing).

Independent Variables

- Alcohol consumption, calories from alcohol
- Alcohol was measured at baseline through the completion of a quantity-frequency questionnaire within the medical history interview; study population were divided into six categories depending on amount of alcohol consumed (i.e., non-drinkers; less than 12 drinks per year; less than one drink per week; one to 6.9 drinks per week; one to 1.9 drinks per day; two or more drinks per day).

Control Variables

- Age, race, height, education, health status (obtained at follow-up based on physician-diagnosed conditions reported), smoking status (questions asked in follow-up interview), physical activity (obtained from questions), total non-alcoholic calories at baseline (based on 24-hour recall), and dieting for weight loss (based on baseline interviews asking if participants were on special diets)
- In prospective analysis:
    - Years of follow-up
    - Reproductive status
    - Baseline BMI.

Description of Actual Data Sample:

- *Initial N:* 14,407 adults aged 25 to 74 years eligible for inclusion in the NHANES 1 study
- *Attrition (final N):*
    - The final number of participants was 7,230 adults, after exclusions
    - Adults who were screened for the NHANES I Epidemiologic follow-up study were excluded from analysis if (number and percent):
        - Vital status data was missing at follow-up: 1,024 (7.1%)
        - They were alive but were not re-interviewed: 838 (5.8%)
        - They had died: 2,022 (14%)
        - Caloric intake information was missing at baseline: 2,270 (15.7%)
        - They were pregnant at baseline or follow-up: 101 (0.7%)
        - Height or weight measurements were unknown at baseline or follow-up: 560 (3.9%)
        - Drinking information was missing on baseline or follow-up: 81 (0.6%)
        - Values for one or more other covariates used in the analysis was missing: 281 (2%).
- *Age:*
    - Range: 25 to 74 years
    - Mean age (years):
        - Non-drinkers: Men, 55; women, 51
        - Those that drank one to 6.9 drinks per week: Men, 46; women, 40
        - Those that drank one to 1.9 drinks per day: Men, 46; women, 40
        - Those that drank two or more drinks per day: Men, 46; women, 40
- *Ethnicity:* Greater than 80% of participants were white
- *Other relevant demographics:*
    - Majority of the participants in the study had less than 12 years of education
    - Summary demographics at baseline:
        - Fewer women drank than did men (67% vs. 81%)

- Men drinkers tended to drink more (15% of the men drank two or more drinks per day vs. 3% of the women)
- Among men and women, those who were white, younger and better educated were more likely to drink
- Men and women drinkers had significantly higher intakes of total daily calories than non-drinkers (this relation persisted even after excluding calories contributed by alcohol)

- Sample size with respect to drinking status at baseline:
  - Non-drinkers: Men, 500; women, 1,505
  - Those that drank less than 12 drinks per year: Men, 344; women, 1,075
  - Those that drank less than one drink per week: Men, 296; women, 625
  - Those that drank one to 6.9 drinks per week: Men, 801; women, 1,043
  - Those that drank one to 1.9 drinks per day: Men, 290; women, 222
  - Those that drank two or more drinks per day: Men, 383; women, 146
- Mean daily calories (kcal) with respect to drinking status at baseline:
  - Non-drinkers: Men: 2,056; women, 1,406
  - Those that drank less than 12 drinks per year: Men, 2,143; women, 1,452
  - Those that drank less than one drink per week: Men, 2,290; women, 1,557
  - Those that drank one to 6.9 drinks per week: Men, 2,344; women, 1,565
  - Those that drank one to 1.9 drinks per day: Men, 2,465; women, 1,596
  - Those that drank two or more drinks per day: Men, 2,562; women, 1,614
- Calories from alcohol (kcal) with respect to drinking status at baseline:
  - Non-drinkers: Men, zero; women, zero
  - Those that drank less than 12 drinks per year: Men, one; women, one
  - Those that drank less than one drink per week: Men, six; women, six
  - Those that drank one to 6.9 drinks per week: Men, 35; women, 29
  - Those that drank one to 1.9 drinks per day: Men, 103; women, 98
  - Those that drank two or more drinks per day: Men, 336; women, 270

- *Anthropometrics:*
  - Although BMI of men was similar for drinkers and non-drinkers, the BMI of women drinkers was lower than that of women non-drinkers
  - Mean BMI (kg/m^2) with respect to drinking status at baseline:
    - Non-drinkers: Men, 25.6; women, 26.6
    - Those that drank less than 12 drinks per year: Men, 26.2; women, 25.7
    - Those that drank less than drink per week: Men, 26.0; women, 24.7
    - Those that drank one to 6.9 drinks per week: Men, 25.8; women, 24.4
    - Those that drank one to 1.9 drinks per day: Men, 25.7; women, 24.1
    - Those that drank two or more drinks per day: Men, 25.8; women, 24.5
- *Location:* United States.

Summary of Results:

Key Findings

- Prospectively, both men and women drinkers tended to gain less weight than did non-drinkers (P=0.006 for trend in women, P=0.11 for trend in men)
- Over the 10 year period 180 men (6.9%) and 482 women (10.4%) had a major weight gain (10kg or more gain) and 173 men (6.6%) and 379 women (8.2%) had a major weight loss (10kg or more loss)

- Drinkers had more stable weight over the 10-year follow-up period
- Drinkers were less likely to have major weight gain or loss (gaining or losing 10kg or more) than were non-drinkers
- Compared with non-drinkers, for those who consumed one to 6.9 drinks per week:
  - Women had an odds ratio (OR)=0.7 (95% CI: 0.5 to 0.9) for major weight gain and an OR=0.7 (95% CI: 0.5 to 1.1) for major weight loss
  - Men had an OR=1.0 (95% CI: 0.6 to 1.6) for major weight gain and an OR=0.7 (95% CI: 0.5 to 1.2) for major weight loss
- For those who consumed two or more drinks per day:
  - Women had an OR=0.5 (95% CI: 0.3 to 1.0) for major weight gain and an OR=0.8 (95% CI: 0.4 to 1.6) for major weight loss
  - Men had an OR=0.9 (95% CI: 0.5 to 1.6) for major weight gain and an OR=1.0 (95% CI: 0.6 to 1.7) for major weight loss.

Mean Difference in Body Weight (kg) Between Non-drinkers and Different Groups of Drinkers at Baseline: First National Health and Examination Survey, 1971 to 1975

	Adjusted Men**	Adjusted Women**
Non-drinkers	**Reference**	**Reference**
Less than 12 drinks per year	1.8 (0.3 to 3.4)	-0.3 (-1.2 to 0.7)
Less than one drink per week	1.1 (-0.6 to 2.8)	-1.8 (-3.0 to -0.6)
One to 6.9 drinks per week	0.7 (-0.6 to 2.0)	-1.4 (-2.5 to -0.3)
One to 1.9 drinks per day	0.7 (-1.0 to 2.4)	-2.3 (-4.2 to -0.4)
Two or more drinks per day	0.4 (-1.1 to 2.0)	-2.3 (-4.5 to -0.1)

**Number in parentheses, 95% confidence interval

Other Findings

Cross-sectional association between alcohol intake and body weight:

- At baseline, male drinkers tended to be heavier than non-drinkers, while women drinkers weighed less than non-drinkers
- Among men, mean body weight among different groups differed little from that of non-drinkers after controlling for potential confounding factors
- Among women, the cross-sectional association at baseline was much stronger than observed for men; that is, body weight decreased substantially with increasing alcohol intake. This inverse relationship decreased but remained significant even after controlling for potential confounding factors.

Author Conclusion:

- For the US adult population, the study found that alcohol was inversely associated with body weight among women, and both men and women drinkers tended to gain less weight than did non-drinkers over a ten-year period
- Drinkers were less likely to have either a major weight gain or loss than non-drinkers
- The study results suggest than alcohol intake is not a risk factor for obesity.

Reviewer Comments:

Authors identified these limitations in the study:

- *Alcohol intake was self-reported and thus likely to be underestimated (if this reporting error does not vary with body weight status, the resulting misclassification would bias the association between alcohol intake and body weight toward null and the weak inverse relation between alcohol and weight gain observed may be a conservative estimate)*
- *While 24-hour dietary recalls can provide reasonable accurate estimates of mean caloric intake for groups, they may not adequately represent and individual's intake*
- *Alcohol intake and body weight may have fluctuated over the follow-up periods in ways not captured by the baseline and follow-up measures and the findings may not provide much insight on the relation between changes in alcohol intake and body weight changes over time.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes

2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	No
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	???
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	No
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	No
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	N/A
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	N/A
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A

5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes

8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes
	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		???
	10.1.	Were sources of funding and investigators' affiliations described?	???
	10.2.	Was the study free from apparent conflict of interest?	???